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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of

Bryan Franz Dufner et al — Examiner: Zheng, Lois L.

Serial No.: 10/075,561 — Art Unit: 1742

Filed: February 13, 2002 — Docket No.: C-2199Re

Title: Electrochemical Cell with a Porous Support Plate

DECLARATION UNDER 37 CFR 1.132

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Carl A. Reiser declares that:

1. He resides at 25 Orchard Street, #19, Stonington, CT.

2. He has a B.S. degree in Mechanical Engineering and has been working in the field of fuel cells and related arts for over 45 years, and is now so engaged on behalf of UTC Fuel Cells, LLC, South Windsor, CT.

3. He is very familiar with the art related to fuel cell electrode support plates, including substrates and contact bi-layers.

4. He has familiarized himself with the above-identified application and with U.S. 6,083,638 (Taniguchi et al) and U.S. 6,030,718 (Fuglevand et al).

5. Taniguchi has a current collector comprising a single porous layer with areas of hydrophilic and hydrophobic material which provide gas paths and water paths through the porous layer normal to its principal plane. The interfaces between hydrophilic and hydrophobic areas are substantially normal to the principal plane. Although Taniguchi's hydrophilic/hydrophobic layer is built on substrate material, he has only one layer and does not have an additional substrate, as called for in claims 1 and 8 of the subject application. Taniguchi does not disclose forming hydrophilic regions in a manner that increases capacitance of the cell, as called for in claims 1 and 8 of the subject application.

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6. The subject application sets forth the structure of the contact bi-layers, in detail which is sufficient for those skilled in the fuel cell art, at 5:36-46 (column 5, lines 36-46) and at 6:24-7:53, and sets forth structure of the substrates at 7:54-8:66.

7. The contact bi-layer structures are disclosed in the subject application as being different from the substrate structures: the contact bi-layers have pore diameters between 0.1 micron and 1.0 micron (7:53), but the substrate, being a Toray TGP-H-060 (7:58), has pore diameters between 27 microns and 37 microns, as is well known in the art; the hydrophilic and hydrophobic regions are distributed randomly in the contact bi-layers but are discrete in the substrates (8:1-8) or the substrates may be all hydrophilic (8:19-48); the contact bi-layers are fibrous, mixtures of (a) high structure carbon black (e.g., Vulcan-XC72) with hydrophobic FEP, and (b) low structure carbon black with hydrophilic proton exchange resin (3:56-62) and (6:51-7:23), while the substrate, such as Toray TGP-H-060 is formed of carbon-carbon fibrous composite, as is well known in the art.

8. Without the supporting substrate, contact bi-layers (as claimed) or current collectors (as in Taniguchi) would be difficult to design and produce to achieve desired fluid transfer.

9. While fuel cell performance is improved by use of substrates, due to the very large pores in the substrates, the contact bi-layers provide a bridge from the relatively coarse substrate to provide a less coarse contact with the electrode for improved ionic, electronic and water flow; the single layer of Taniguchi is not the same as the substrate plus contact bi-layer of claims 1 and 8 of the subject application.

10. Fuglevand discloses (Fig. 26, 9:40 et seq.) a layer 171, having a hydrophobic gradient normal to the principal plane of the layer, between a hydrophobic layer 172 and a membrane assembly 154: this is not the same as the "partially hydrophobic bilayer disposed between said hydrophilic substrate layer and said membrane electrode assembly" as called for in claim 17.

11. Fuglevand's carbon backing layer 172 comprises carbon cloth, paper or sponge with a hydrophobic polymer layer applied to it (10:10-18) and a further coating of a slurry of carbon and a hydrophobic binding resin (10:32-36) to form the first diffusion layer 171 (10:51-56).

12. An alternative form (10:59-65) applies successive coats of the "above described" binding resin, which is hydrophobic (10:32-36), to achieve a hydrophobic gradient in the first diffusion layer 171.

13. Fuglevand discloses (9:54-9:60) that the layer 171 is a composite coating of successive hydrophobic layers of different hydrophobicity, from least hydrophobic to most hydrophobic; no layer is hydrophilic.

14. Although Fuglevand discloses (10:59-11:5) that the given hydrophobicity may be achieved by selecting a predetermined mixture of hydrophobic or hydrophilic binding resins, and although Fuglevand states (11:5-11), "As was discussed above...the coatings...closest to porous carbon backing layer (the second diffusion layer) may be the most hydrophilic or the least hydrophilic....", the only antecedent reference to the direction of increased or decreased hydrophicity or hydrophobicity is at 9:60-65, which states "...the successive layers closest to the second diffusion layer 172 may be the least hydrophobic of all the successive layers, or may be the most hydrophobic."

15. One skilled in the fuel cell arts would understand that the result would be hydrophobic, in each successive layer of the diffusion layer 171, particularly in view of 9:54-65.

16. Because Fuglevand's variations in philicity/phobicity are perpendicular to the variations in Taniguchi, one skilled in the fuel cell arts would not be motivated to combine the first diffusion layer 171 of Fuglevand with the current collector of Taniguchi.

17. If the first diffusion layer 171 of Fuglevand was incorporated into the two-phase porous support plates of Taniguchi, its hydrophobicity would block the hydrophilic areas, obstructing the water flow paths. See Taniguchi 2:21-24 and 2:28-35.

18. Fuglevand's first diffusion layer 171 is adjacent the membrane 151; if that were interposed between Taniguchi's membrane 11 and philic/phobic current collectors 40, 41, it would be a phobic diffusion layer between a philic/phobic diffusion layer and a membrane electrode assembly; this is not the "partially hydrophobic bilayer disposed between said hydrophilic substrate layer and said membrane electrode assembly" as called for in claim 17; there is nothing in either patent to suggest placing Fuglevand's layers 170, 171 or 172 outside of (not near the membrane) Taniguchi's diffusion layer (40, 41), and doing so would not provide a bilayer between a hydrophilic substrate and the membrane, as in claim 17.

19. The application discloses at 2:7 and at 3:8 "porous water transport plates" and describes the multiple purposes thereof at 3:10-30. In the prior art, the term "water transport plate" refers to reactant gas flow field plates having gas flow channels on one surface and water flow channels on an opposite surface, or adjacent to a surface with water flow channels, which is porous and at least partially hydrophilic, so as to permit water to transfer through plane between water channels and electrode supports.

20. All statements made herein of his own knowledge are true and that all statements made on information and belief are believed to be true and further that these statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Carl A. Reiser

Carl A. Reiser

10/31/06
Date